In [1]:
```
pip install numpy pandas tensorflow scikit-learn matplotlib
```

```
Requirement already satisfied: numpy in c:\users\teja dithya\anaconda3\lib\site-packages (1.24.3)
Requirement already satisfied: pandas in c:\users\teja dithya\anaconda3\lib\site-packages (2.0.3)
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```

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Requirement already satisfied: idna<4,>=2.5 in c:\users\teja dithya\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tenso
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Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\teja dithya\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorflow-intel==2.17.0->tensorflow) (1.26.16)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\teja dithya\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorflow-intel==2.17.0->tensorflow) (2023.7.22)
Requirement already satisfied: markdown>=2.6.8 in c:\users\teja dithya\anaconda3\lib\site-packages (from tensorboard<2.18,>=2.17
->tensorflow-intel==2.17.0->tensorflow) (3.4.1)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\teja dithya\anaconda3\lib\site-packages (from t
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```

```
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>keras>=3.2.0->tensorflow-intel==2.17.0->tensorflow) (0.1.0)
Note: you may need to restart the kernel to use updated packages.
```

import the dataset

In [2]:
```
import pandas as pd
import numpy as np

# Load the dataset
sales_data = pd.read_csv('train.csv')
store_data = pd.read_csv('store.csv')

# Merge datasets
data = pd.merge(sales_data, store_data, on='Store', how='left')

# Preview the data
print(data.head())
```

```
C:\Users\Teja Dithya\AppData\Local\Temp\ipykernel_15236\2976363199.py:5: DtypeWarning: Columns (7) have mixed types. Specify dty
pe option on import or set low_memory=False.
  sales_data = pd.read_csv('train.csv')
```

```
   Store  DayOfWeek        Date  Sales  Customers  Open  Promo StateHoliday  \
0      1          5  2015-07-31   5263        555     1      1            0
1      2          5  2015-07-31   6064        625     1      1            0
2      3          5  2015-07-31   8314        821     1      1            0
3      4          5  2015-07-31  13995       1498     1      1            0
4      5          5  2015-07-31   4822        559     1      1            0

   SchoolHoliday StoreType Assortment  CompetitionDistance  \
0              1         c          a               1270.0
1              1         a          a                570.0
2              1         a          a              14130.0
3              1         c          c                620.0
4              1         a          a              29910.0

   CompetitionOpenSinceMonth  CompetitionOpenSinceYear  Promo2  \
0                        9.0                    2008.0       0
1                       11.0                    2007.0       1
2                       12.0                    2006.0       1
3                        9.0                    2009.0       0
4                        4.0                    2015.0       0

   Promo2SinceWeek  Promo2SinceYear    PromoInterval
0              NaN              NaN              NaN
1             13.0           2010.0  Jan,Apr,Jul,Oct
2             14.0           2011.0  Jan,Apr,Jul,Oct
3              NaN              NaN              NaN
4              NaN              NaN              NaN
```

pre-process the data

In [3]:

```
# Handle missing values
data.fillna(0, inplace=True)

# Convert Date column to datetime
data['Date'] = pd.to_datetime(data['Date'])

# Extract year, month, and day
data['Year'] = data['Date'].dt.year
data['Month'] = data['Date'].dt.month
data['Day'] = data['Date'].dt.day
data['DayOfWeek'] = data['Date'].dt.dayofweek

# Encode categorical variables
```

```
data['StateHoliday'] = data['StateHoliday'].astype('category').cat.codes
data['StoreType'] = data['StoreType'].astype('category').cat.codes
data['Assortment'] = data['Assortment'].astype('category').cat.codes

# Drop unnecessary columns
data.drop(['Date', 'Customers'], axis=1, inplace=True)
```

split the data

In [4]:
```
from sklearn.model_selection import train_test_split

# Feature matrix and target variable
X = data.drop('Sales', axis=1)
y = data['Sales']

# Split the data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

In [5]:
```
print(X_train.dtypes)
```

```
Store                         int64
DayOfWeek                     int32
Open                          int64
Promo                         int64
StateHoliday                   int8
SchoolHoliday                 int64
StoreType                      int8
Assortment                     int8
CompetitionDistance         float64
CompetitionOpenSinceMonth   float64
CompetitionOpenSinceYear    float64
Promo2                        int64
Promo2SinceWeek             float64
Promo2SinceYear             float64
PromoInterval                object
Year                          int32
Month                         int32
Day                           int32
dtype: object
```

scale the data

In [7]:
```
!pip install pandas scikit-learn
from sklearn.preprocessing import MinMaxScaler, OneHotEncoder
```

```
Defaulting to user installation because normal site-packages is not writeable
Collecting pandas
  Downloading pandas-2.2.3-cp312-cp312-win_amd64.whl.metadata (19 kB)
Collecting scikit-learn
  Downloading scikit_learn-1.5.2-cp312-cp312-win_amd64.whl.metadata (13 kB)
Collecting numpy>=1.26.0 (from pandas)
  Downloading numpy-2.1.3-cp312-cp312-win_amd64.whl.metadata (60 kB)
Collecting python-dateutil>=2.8.2 (from pandas)
  Downloading python_dateutil-2.9.0.post0-py2.py3-none-any.whl.metadata (8.4 kB)
Collecting pytz>=2020.1 (from pandas)
  Downloading pytz-2024.2-py2.py3-none-any.whl.metadata (22 kB)
Collecting tzdata>=2022.7 (from pandas)
  Downloading tzdata-2024.2-py2.py3-none-any.whl.metadata (1.4 kB)
Collecting scipy>=1.6.0 (from scikit-learn)
  Downloading scipy-1.14.1-cp312-cp312-win_amd64.whl.metadata (60 kB)
Collecting joblib>=1.2.0 (from scikit-learn)
  Downloading joblib-1.4.2-py3-none-any.whl.metadata (5.4 kB)
Collecting threadpoolctl>=3.1.0 (from scikit-learn)
  Downloading threadpoolctl-3.5.0-py3-none-any.whl.metadata (13 kB)
Collecting six>=1.5 (from python-dateutil>=2.8.2->pandas)
  Downloading six-1.16.0-py2.py3-none-any.whl.metadata (1.8 kB)
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Downloading pytz-2024.2-py2.py3-none-any.whl (508 kB)
Downloading scipy-1.14.1-cp312-cp312-win_amd64.whl (44.5 MB)
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Downloading tzdata-2024.2-py2.py3-none-any.whl (346 kB)
Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)
Installing collected packages: pytz, tzdata, threadpoolctl, six, numpy, joblib, scipy, python-dateutil, scikit-learn, pandas
Successfully installed joblib-1.4.2 numpy-2.1.3 pandas-2.2.3 python-dateutil-2.9.0.post0 pytz-2024.2 scikit-learn-1.5.2 scipy-1.
14.1 six-1.16.0 threadpoolctl-3.5.0 tzdata-2024.2
  WARNING: The scripts f2py.exe and numpy-config.exe are installed in 'C:\Users\Teja Dithya\AppData\Roaming\Python\Python312\Scr
ipts' which is not on PATH.
  Consider adding this directory to PATH or, if you prefer to suppress this warning, use --no-warn-script-location.

[notice] A new release of pip is available: 24.2 -> 24.3.1
[notice] To update, run: C:\Python312\python.exe -m pip install --upgrade pip
```

scale the data

In [8]:

```python
#Assuming 'data' is your DataFrame
# ... (your existing code for loading and preprocessing data) ...

# Feature matrix and target variable
X = data.drop('Sales', axis=1)
y = data['Sales']

# Split the data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Create a OneHotEncoder for 'PromoInterval'
encoder = OneHotEncoder(sparse_output=False, handle_unknown='ignore') # sparse=False for numpy array output

X_train['PromoInterval'] = X_train['PromoInterval'].astype(str)
X_test['PromoInterval'] = X_test['PromoInterval'].astype(str)

# Create a OneHotEncoder for 'PromoInterval'
encoder = OneHotEncoder(sparse_output=False, handle_unknown='ignore')  # sparse=False for numpy array output

# Fit and transform the 'PromoInterval' column in the training data
```

```
promo_interval_train = encoder.fit_transform(X_train[['PromoInterval']])

# Transform the 'PromoInterval' column in the testing data
promo_interval_test = encoder.transform(X_test[['PromoInterval']])

# Get feature names for the encoded columns
promo_interval_feature_names = encoder.get_feature_names_out(['PromoInterval'])

# Create DataFrames for the encoded 'PromoInterval'
promo_interval_train_df = pd.DataFrame(promo_interval_train, columns=promo_interval_feature_names, index=X_train.index)
promo_interval_test_df = pd.DataFrame(promo_interval_test, columns=promo_interval_feature_names, index=X_test.index)

# Drop the original 'PromoInterval' column and concatenate the encoded columns
X_train = X_train.drop('PromoInterval', axis=1).join(promo_interval_train_df)
X_test = X_test.drop('PromoInterval', axis=1).join(promo_interval_test_df)

# Now you can apply MinMaxScaler
scaler_X = MinMaxScaler()
scaler_y = MinMaxScaler()

X_train = scaler_X.fit_transform(X_train)
X_test = scaler_X.transform(X_test)

y_train = scaler_y.fit_transform(y_train.values.reshape(-1, 1))
y_test = scaler_y.transform(y_test.values.reshape(-1, 1))
```

reshape the data

In [9]:
```
X_train = X_train.reshape((X_train.shape[0], 1, X_train.shape[1]))
X_test = X_test.reshape((X_test.shape[0], 1, X_test.shape[1]))
```

build the model

In [11]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout

# Define the model
model = Sequential([
    LSTM(50, activation='relu', input_shape=(X_train.shape[1], X_train.shape[2])),
    Dropout(0.2),
    Dense(1)
```

```
])

# Compile the model
model.compile(optimizer='adam', loss='mse')

# Summary of the model
model.summary()
```

```
c:\Users\Teja Dithya\anaconda3\Lib\site-packages\keras\src\layers\rnn\rnn.py:204: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(**kwargs)
```

Model: "sequential"

Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 50)	14,400
dropout (Dropout)	(None, 50)	0
dense (Dense)	(None, 1)	51

Total params: 14,451 (56.45 KB)

Trainable params: 14,451 (56.45 KB)

Non-trainable params: 0 (0.00 B)

train the model

In [13]:
```
# Train the model
history = model.fit(X_train, y_train, epochs=10, batch_size=32, validation_data=(X_test, y_test), verbose=1)
```

```
Epoch 1/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 36s 1ms/step - loss: 0.0040 - val_loss: 0.0035
Epoch 2/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 31s 1ms/step - loss: 0.0037 - val_loss: 0.0033
Epoch 3/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 34s 1ms/step - loss: 0.0036 - val_loss: 0.0032
Epoch 4/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 35s 1ms/step - loss: 0.0035 - val_loss: 0.0030
Epoch 5/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 31s 1ms/step - loss: 0.0034 - val_loss: 0.0030
Epoch 6/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 35s 1ms/step - loss: 0.0033 - val_loss: 0.0029
Epoch 7/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 32s 1ms/step - loss: 0.0032 - val_loss: 0.0028
Epoch 8/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 32s 1ms/step - loss: 0.0032 - val_loss: 0.0028
Epoch 9/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 32s 1ms/step - loss: 0.0031 - val_loss: 0.0027
Epoch 10/10
25431/25431 ━━━━━━━━━━━━━━━━━━━━ 33s 1ms/step - loss: 0.0031 - val_loss: 0.0027
```

evalute the model

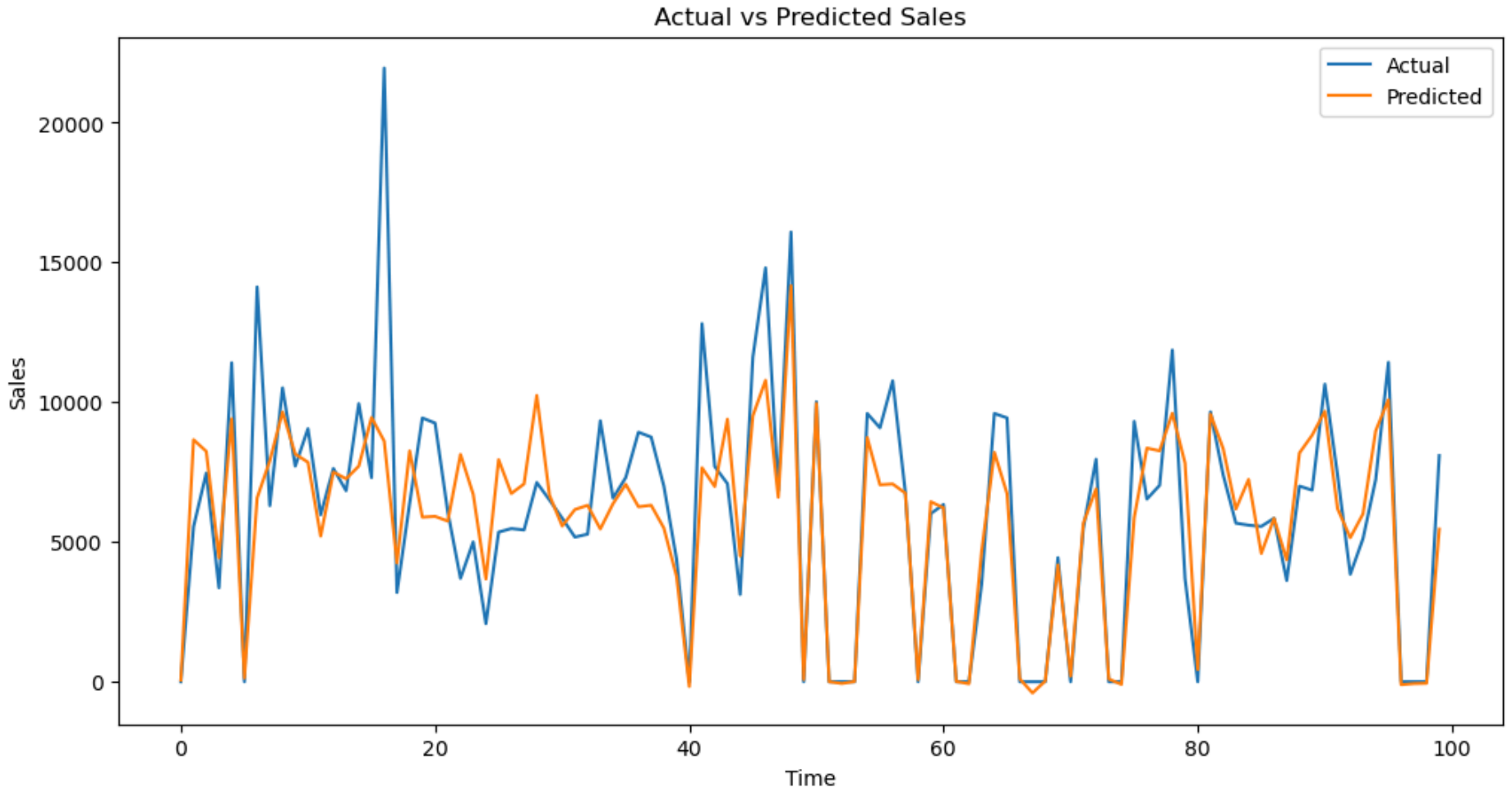
In [14]:

```python
from sklearn.metrics import mean_absolute_error, mean_squared_error

# Predictions
y_pred = model.predict(X_test)

# Inverse transform predictions and actuals
y_pred = scaler_y.inverse_transform(y_pred)
y_test = scaler_y.inverse_transform(y_test)

# Calculate metrics
mae = mean_absolute_error(y_test, y_pred)
rmse = np.sqrt(mean_squared_error(y_test, y_pred))

print(f"MAE: {mae:.2f}")
print(f"RMSE: {rmse:.2f}")
```

```
6358/6358 ━━━━━━━━━━━━━━━━━━━━ 5s 782us/step
MAE: 1323.82
RMSE: 1988.80
```

visuaize model

In [15]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(12, 6))
plt.plot(y_test[:100], label='Actual')
plt.plot(y_pred[:100], label='Predicted')
plt.title('Actual vs Predicted Sales')
plt.xlabel('Time')
plt.ylabel('Sales')
plt.legend()
plt.show()
```


Actual vs Predicted Sales
Actual
Predicted
Sales
Time
0
5000
10000
15000
20000
0
20
40
60
80
100

In [ ]:

In [ ]: